

CLAIMS

1. A multi-chamber vacuum coating apparatus for coating a substrate tape utilizing PLD and a reel to reel tape transport system comprising
 - a payout spool chamber containing at least one spool of uncoated substrate tape;
 - one or more deposition chambers;
 - a take-up spool chamber capable of accommodating at least one spool of coated substrate tape;

wherein the one or more deposition chambers comprises a substrate heater, a motorized target manipulator, and at least one target mounted on the target manipulator where the target manipulator imparts rotary and oscillatory motion to the at least one target;

the payout chamber and the deposition chamber both having an opening therein of sufficient dimension to permit at least one translating tape to be inserted therethrough;

the deposition chamber and the take-up spool chamber both having an opening therein of sufficient dimension to permit at least one substrate tape to be inserted there through;

the one or more deposition chambers each have the substrate heater and the target manipulator disposed therein such that the heater and the at least one target manipulator define a deposition zone therebetween; and

the exterior wall of the apparatus contains openings for at least one laser beam.
2. The apparatus of claim 1 wherein there is one deposition chamber.
3. The apparatus of claim 1 wherein the heater is a multizone heater.
4. The method of claim 1 wherein the exterior wall of the apparatus contains openings for multiple laser beams.

5. The apparatus of claim 1 wherein multiple targets are mounted on the target manipulator.
6. The method of claim 1 wherein the spool chambers are sized to accommodate from about 2 to about 20 spools of substrate tape.
7. The apparatus of claim 1 wherein the spool chambers are sized to accommodate from about 4 to about 12 spools of substrate tape.
8. The apparatus of claim 1 wherein the multizone heater comprises three zones.
9. The apparatus of claim 1 also containing seals in the opening in the chamber walls that maintain a selected pressure differential between the chambers.
10. A method for the continuous production of long lengths of HTS coated tape via the deposition of HTS material onto a translating buffered metal substrate tape using utilizing the apparatus of claim 1 comprising the steps of:
 - loading at least one payout spool of buffered substrate tape into a payout spool chamber;
 - lacing the at least one spool of substrate tape from the payout chamber through the PLD chamber and into the take up spool chamber, all the while riding on idlers;
 - heating the buffered tape to a deposition temperature between about 600 °C and about 950 °C;
 - setting the oxygen pressure of the deposition chamber to between about 50 and about 1000 mTorr;
 - engaging the motors controlling the payout spool and the take-up spool to translate the substrate tape through the deposition chamber;
 - activating the target manipulator;

activating the at least one laser to form at least one laser beam, and focusing the at least one laser beam to have a laser energy density between one and six J/cm² such that multiple instantiations of the laser beam simultaneously impinge on multiple instantiations of the target mounted onto the target manipulator, resulting in the creation of multiple instantiations of a plume of vaporized target that slightly overlap;

depositing vaporized target onto the translating substrate by translating the substrate through the deposition zone; and

collecting the coated substrate on at least one take up spool.

11. The method of claim 10 wherein the substrate heater is a multizone heater.
12. The method of claim 10 wherein at least two laser beams are formed.
13. The method of claim 10 wherein the target manipulator holds multiple targets.
14. The method of claim 10 wherein the spool chambers are sized to accommodate from about 2 to about 12 spools of substrate tape.
15. The method of claim 10 wherein there are at least two laser beams and each laser beam is produced by a different laser.
16. The method of claim 10 wherein the multizone heater comprises three zones.
17. The method of claim 10 wherein the buffered tape is heated to a deposition temperature between about 750 °C and about 830 °C.
18. The method of claim 10 wherein the oxygen pressure in the deposition chamber is set to about 200 mTorr.
19. The method of claim 16 wherein the multizone heater heats by a combination of conductive and radiative heat transfer.

20. The method of claim 10 wherein the substrate is maintained in contact with a susceptor as it translates through the deposition zone.
21. The method of claim 20 wherein the susceptor which is maintained in contact with the susceptor as it translates through the deposition zone is transversely concavely curved and has a radius of from about 5 to about 10 meters.